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EURO-LABS

EUROpean Laboratories for Accelerator Based Sciences
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DELIVERABLE REPORT

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Abstract:

This deliverable reports on the activities of Training in the first 2 years under task 5.4. It contains the reports on the realization of all events organized or supported under the project and on the decisions, taken for the continuation of the activities in the coming year(s). It includes the feedback from the young participants (trainees) and from the organizers and trainers.

In the framework of the training activities, reports are presented on (a) Basic Training Schools (BTS) that have been so far organised: the 2023 (BTS23) at IFIN-HH, and the BTS24 in Warsaw. (b) two Advanced Training Schools in 2024, Operation of accelerators was organized CERN and the other on Open Data Management is to be organized at GSI/FAIR. Reports are also included on schools that were co-sponsored by EURO-LABS in 2024: the R-matrix school and the upcoming NIC XI school.

EURO-LABS Consortium, 2024

For more information on EURO-LABS, its partners and contributors please see <https://web.infn.it/EURO-LABS/>

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Delivery Slip

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Executive summary

This deliverable reports on the training activities under Task 5.4 of the European project EURO-LABS. It includes a brief description of establishing of the Training Science Board (TSB) concluded in February 2023, its proposed duties and competences, its constituents – as already reported in MS38 - and the first decisions. As part of the EURO-LABS proposal, a direct contribution to the education, formation and training of the new generations of scientists, working in nuclear physics, in high energy physics accelerators and detectors was planned. This is through the organization and support of events where there is direct contact between the current and future specialists. We have proposed to have ideally each year one Basic Training School (BTS) and one Advanced Training School (ATS), and in addition to support events that are organized by Beneficiaries of EURO-LABS that fit the scope of our training Task 5.4.

By the end of M24, the following schools were organized:

BTS23 in September 13th –23rd, 2023, at IFIN-HH, Bucharest-Magurele, Romania

ATS23 in June 3rd -7th, 2024, at CERN

BTS24 in June 18th -27th 2024, in Warsaw, Poland, hosted by HIL and ICST, Warsaw and ATS24 planned for Nov. 24-27, at GSI/FAIR, Darmstadt, Germany.

Additionally, EURO-LABS have supported the “R-matrix school” in Edinburgh. The TSB has approved that the support (co-sponsor) the NIC XI school in Dresden.

All events organized or supported so far were very successful, based on the number of participants, and their positive feedback. The organizers and trainers, have seen how such events can be even better organized and planned to further increase the impact for the youngsters.

Below are some of the major feedback that was received:

- Hands-on events are most appreciated by trainees*
- Diversity of equipment and installations used was well appreciated by those who are at the point of choosing a career path for their upcoming careers.*
- Basic Schools of 10-12 days long allow the trainees to work directly and to know each-other, Younger scientists are the most appreciated trainers*

1. INTRODUCTION

EURO-LABS is a European project that brings together for the first time in Europe the three scientific communities namely Nuclear Physics, Accelerators and Detectors for high energy Physics. This network is made of 33 research and academic institutions from 18 countries (25 beneficiaries and 8 associated partners) from European and non-EU countries, involving 45 Research Infrastructures. Its basic purpose is to encourage the common use of European Research Infrastructures (RI), to increase the reach within Europe and outside it, and to increase the efficiency of its use. The project aims at extending its geographical reach, by including both small and large facilities, as well as countries and institutions without RI by offering TNA support.

To assure and improve the participation of new generations of scientists, a strong training component in project activities was included. This is spelled out in the 5.4 task of the WP5. The proposal envisioned the organization yearly of basic and advanced training schools, by different beneficiary institutions of EURO-LABS, as well as the identification and partial support of other training events that are organized in Europe.

In order to coordinate these activities, the proposal included the establishment of a Training Scientific Board. This was accomplished in the first 6 months of the project. It is described in Sect. 2 of this report. Sect. 3 reports on the basic and advanced training schools directly organized in 2023 and 2024, while Sect. 4 reports on the training activities that EURO-LABS supported (co-sponsored). In each case, the feedback received from the participants are presented briefly. The next steps are described briefly in Section 5.

2. TRAINING SCIENTIFIC BOARD

The EURO-LABS proposal aims to enhance the competitiveness of our research infrastructures and its technical capabilities. The project included as the first activity under Task 5.4 Training, the formation of a Training Scientific Board (TSB) in the first six months of the EURO-LABS project with the purpose to “plan a coherent, stable, and predictable system of training schools and events”.

To this aim, during EURO-LABS’ Kick-Off-Meeting, discussions were started with project’s leaders and with participants about the composition and responsibilities of this board. It was agreed that a nine members board would cover a wide range of expertise and beneficiaries. MS38 “Selection of the Training Scientific Board” (Feb. 2023) had reported on the TSB.

TSB MEMBERS

List of TSB members:

1. *Livius Trache - IFIN-HH, Romania – Task 5.4 Leader (Chair)*
2. *Maria J.G. Borge – IEM-CSIC, Spain – WP5 Coordinator (Co-chair)*
3. *Rosanna Depalo - INFN and contact with ChETEC-INFRA, Italy*
4. *Ilias Efthymiopoulos - HEP Accelerators (CERN), Switzerland*
5. *Hanna Franberg-Delahaye – GANIL, France*
6. *Magdalena Kowalska - CERN/ISOLDE, Switzerland*

7. *Pawel Napiorkowski /Urszula Gryczka - HIL/INCT, Poland*
8. *Christoph Scheidenberger – GSI/FAIR, Germany*
9. *Marcel Stanitzki - HEP Detectors DESY, Germany*

EVENTS PLANNED

Based on the initial discussions and the proposals received by TSB, the following events were chosen for the first 2 years:

- **Basic training school of 2023** organized at IFIN-HH, in Sept. 2023 with a majority of the emphasis on hands-on activities. The organizers had applied and obtained from the PAC of the tandem accelerator complex of IFIN-HH beamtime at the 3 MV and 9 MV tandems for use during the school. 27 students were selected for a period of 12 days. Organizer: Livius Trache and his team
- **Basic training school of 2024** organized jointly in Warsaw by the Heavy Ion Laboratory, University of Warsaw and the Institute of Nuclear Chemistry and Technology in June 2024. 18 participants for the 10 days school were selected. The workshop was intended for PhD students starting their thesis. Organizers: Piotr Napiorkowski (HIL) and Urszula Gryczka (INCT).
- **EURO-LABS' Advanced training school of 2024** was organized at CERN. **Title:** "Advanced Training Sessions in the operation of High-Energy accelerators at CERN".
- **GANIL proposed to organize an Advanced training school for the technical and engineering staff in 2026** together with the IPAC'26.
- EURO-LABS will also **support the participation of up to 6 students** and 1 teacher at the NPA XI school organized by ChETEC-INFRA at HZDR Dresden from 15th to 22nd of September 2024

3. REPORTS ON THE SCHOOLS ORGANIZED

REPORT ON THE FIRST EURO-LABS BASIC TRAINING SCHOOL AT IFIN-HH - BTS23

The Training Science Board (TSB) decided in February 2023 to grant the organization of the first basic training school to IFIN-HH. The local organizers proposed to host it on September 13th -23rd, 2023, and to make it a fully hands-on event, based on experiments carried out at two of IFIN-HH's tandem accelerators in Bucharest-Magurele. An application was submitted in advance to institute's PAC for 3 days of beamtime at each of the 3 and 9 MV machines.

This was very appreciated by the students who were from all over the world. While we started with plans to host about 15 students, the demand was so high that we had to accept double that number. We accepted 20 applicants from Europe (fully supported for travel and accommodation expenses) and 4 from outside Europe (S. Africa, Brazil, Mexico), supported by EURO-LABS for accommodation while the travel expenses were borne by their own institutions.. Additionally 3 local

students, from two Bucharest universities also were selected. In the end we had 27 students (10 women, 37%), from bachelor degrees (2) to master students, PhD students and postdocs (2). The time for lectures were kept to the minimum required, focussing mainly on hands on experience. A 3 day experiment at the smaller 3 MV tandetron accelerator, was, then followed with a 3 days experiment at the larger 9 MV tandem accelerator. A visit on Saturday to an ultra-low background laboratory where the IFIN-HH institute has in a salt mine (close to Carpathian mountains) was also made between the two experiments. The students were divided into 3 working groups and each went through most of the basics of experimental nuclear physics: accelerators, detectors, electronics, targets and target making, data acquisition from single channel to multi-parameter acquisition and analysis. Activities were also dedicated to in-beam data taking, de-activation measurements on-site and in the salt mine, more complex setup at the ROSPHERE array with ancillary neutron and particle detectors, etc.

The Friday of the first week was dedicated to data analysis of first experiment and to visit the various large infrastructures IFIN-HH has on the same campus, but not involved directly in the program: Department of Hadron Physics, the gamma-ray irradiator IRASM, ELI-NP, RoAMS, etc. This was also done in separate groups. The second Friday, Sep 22nd, a joint wrap-up session was scheduled where each group presented its results, discussed their impressions and feedback. The dedication and inspirations put in reports were remarkable. Diversity, while not sought by organizers can be illustrated by one group reporting: we are 9 people from 8 countries and 5 continents'. One can see that in the photo below, taken in the impressive salt mine.



Fig. 1. Participants at the BTS23 event, at the IFIN-HH's ultra-low background laboratory in the Slanic salt mine.

It should be noted that the event was essentially conducted by a team of young staff from IFIN-HH, led by dr. Razvan Lica, dr. Alexandra Spiridon and dr. Constantin Mihai.

The program is detailed on event's website: <https://indico.nipne.ro/event/246/> under "timeline". Given the rich infrastructure of IFIN-HH (including accommodation and food) and the help of the Management, the event went smoothly and stayed on the budget.

This activity was highly appreciated at the EURO-LABS General Assembly meeting in Krakow, Oct. 2023 and a short report on it was included as a highlight in the NuPECC Long Range Plan 2024 “Opportunities and Challenges for Nuclear Physics in Europe” and is shown below .

Highlight: EURO-LABS Basic Training School BTS23

The first basic training school BTS23 of the HORIZON Europe project, EURO- LABS, used six days of beam time at the IFIN- HH’s tandem accelerators in Bucharest- Magurele for hands-on experiments using state-of-the-art research equipment. The school was attended by 27 students from 5 continents was seen as a great success by the participants <https://indico.nipne.ro/event/246/>. The team of early career researchers from IFIN-HH was led by Dr. Razvan Lica, Dr. Alexandra Spiridon, Dr. Dana State and Dr. Constantin Mihai.



The Basic Training School in 2023 questionnaire

The students participating at BTS23 were asked through a Questionnaire to comment on the school and give suggestions further improvements. The participants were asked to evaluate 10 different aspects on a scale from 1 to 5, with 5 being best. Given below are the compilation of the results of the questionnaire:

	Phase / Activity	Av rate
1	Event announcement	4.0
2	Response to your application	4.8
3	Final directions for arrival	4.9
4	Accommodation	4.4
5	Meals	4.1
6	Timetable	4.4
7	Content of lectures	4.2
8	Quality of presentations	4.3
9	Interactions with peers	4.8

10	Leisure time	4.2
11	Overall satisfaction	4.5

We quote also here a selection of the opinions of the students about the event:

- “I have enjoyed a lot the experience of the school and I think it has given me an experience very difficult to get in other circumstances. Also, the other students I have met here were very nice and we could work pretty well as a team. For me, this has also been a great opportunity to make new bonds and connections between students for future collaborations. I would like to take the time to congratulate the organizers for all the effort on this event and say thanks for the opportunity to be part of it.
- It was a great experience to be here, I learned a lot, and enjoyed my visit to each facility.
- Even though we sometimes need additional material, Dana, Alexandra and all the others provided everything on the spot. Big respect that they managed everything.
- More time to perform the data analysis for the presentations of the report of the student report. Also, it would be better to have a lecture about the steps we must follow to successfully complete it. Maybe 3 sessions spread throughout the school would be good to check the preliminary results and guide the students. Also, more hands-on activities... I would like to have more time for creating and studying the targets. “

There were a lot of words of appreciation about the social events included in the school.

INTERNATIONAL BASIC TRAINING SCHOOL ON ACCELERATORS - BTS24

On June 18-27 2024, the International Basic Training School on Accelerators (BTS24) (<https://indico.slj.uw.edu.pl/event/8/>) was held in Warsaw, Poland. The school was organized jointly by the Heavy Ion Laboratory, University of Warsaw and the Institute of Nuclear Chemistry.

The participants of the school were 18 (8 women, 44%) students and post-doc selected from among 39 applications received. The participants were originally from 14 countries: Argentina, Botswana, Bulgaria, Costa Rica, El Salvador, France, Mexico, Poland, Portugal, Romania, Sweden, Slovenia, Spain, Ukraine, although all were European or affiliated to European Research Institution connected to EURO-LABS except for one affiliated to an Ukrainian University. More information is available on the website <https://www.slj.uw.edu.pl/en/bts24/>.

Young physicists had the opportunity to expand their knowledge by participating in lectures given by local and international experts. The subjects presented in the lectures included the detection of ionizing radiation, introduction to gamma spectroscopy, basics of target preparation, fundamentals of nuclear reactions, production of radioisotopes for medical applications, and acceleration of heavy ions.

The critical part of the workshop was acquiring practical laboratory skills and developing teamwork. Participants carried out independent experiments in small groups, using the unique research equipment available at the HIL Warsaw, and presented their results in a session towards the end of the school. Three experiments were performed on a ^{20}Ne beam at the energy of 77 MeV from the Warsaw Cyclotron. The obtained data were subject to simple analysis aimed at answering research questions posed by the instructors. The workshop program was supplemented by a series of lectures introducing the issues related to the measurements performed and current problems of nuclear physics and applications in medicine and energy.

The students were divided into 6 groups for hands-on activities on the following experimental topics:

- A. Gamma-ray Spectroscopy
- B. Fast-timing measurements
- C. Target production and its thickness measurements
- D. Study of the effects of ionizing radiation on biological material
- E. Gas/Si telescopes in charge particle spectroscopy.
- F. Neutron measurements

Each group worked only in one of the above subjects so as to get a deeper knowledge of a given subject. The workshop was summarized with a mini-symposium. Participants gave presentations based on their measurements and analysis.

Additionally for two days (June 19th and 20th) exercises were organized at the Institute of Nuclear Chemistry and Technology aiming to provide information on industrial applications of electron beam accelerators and dosimetry methods of electron beam control.

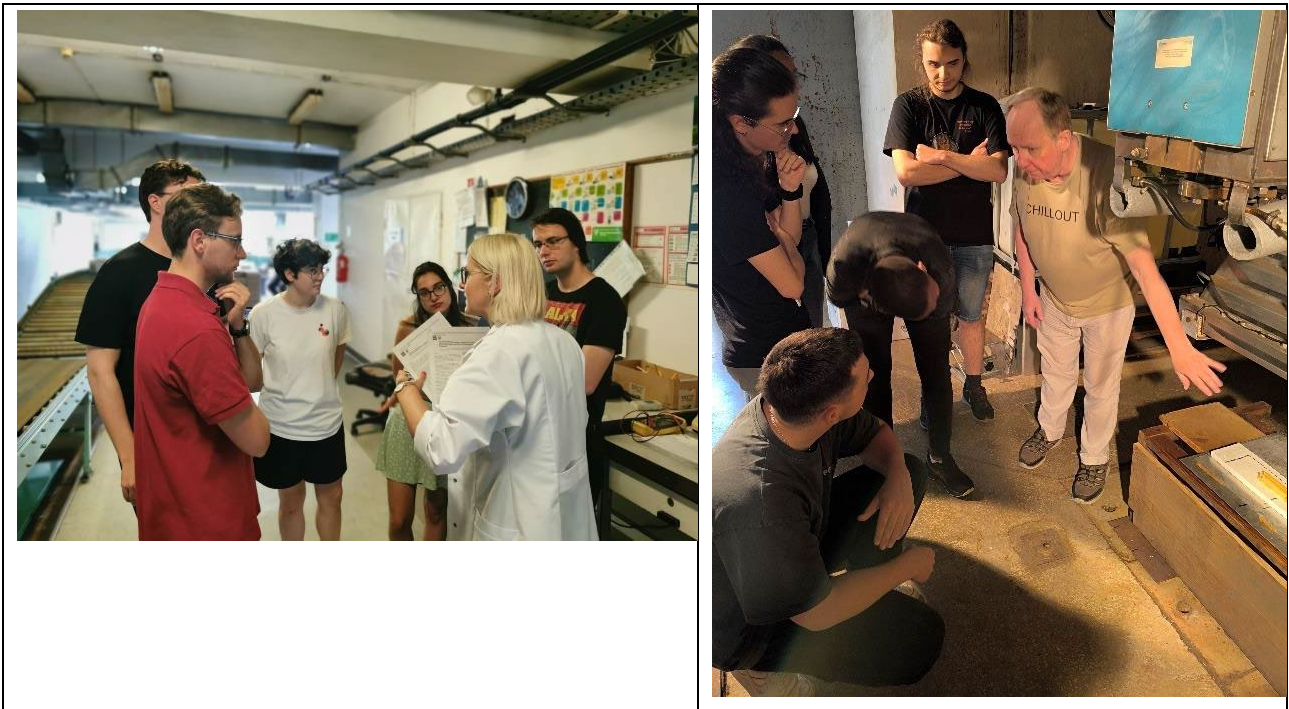
At INCT the BTS participants were welcomed by the Director of the Institute, Prof. Ph.D. Andrzej G. Chmielewski. The introductions to the experiments were the presentations on general aspect of particle accelerators technology, sterilization of medical devices, ionizing radiation dosimetry:

- Environmental Applications of electron beam accelerators - Andrzej G. Chmielewski
- General aspect of particle accelerators technology – Sylwester Bułka
- INCT Radiation Sterilization Plant – Magdalena Rzepna
- Laboratory for Measurements of Technological Doses – Marta Walo
- Introduction to experiments – Urszula Gryczka

The exercises were carried out using two accelerators installed at INCT: the Elektronika accelerator generating an electron beam with an energy of up to 10 MeV. This accelerator is installed in INCT Sterilization Facility of Medical Devices and is used for both research and commercial scale irradiation. The second machine used in experiments was the ILU-6 accelerator, where measurements were made for an electron beam with an energy of 1.3 and 1.7 MeV. This accelerator is an experimental platform aiming to provide different parameters of the electron beam for laboratory or pilot scale irradiation to investigate environmental applications and materials modifications. The experiments aim to give introduction on electron beam irradiation process control and demonstrate the range of energetic electrons beams. As part of the training, the properties of diffraction dosimetry

and measurement methods were presented. The experiments used the following dosimetry systems: alanine palettes and electron resonance spectroscopy, calorimetry and foil dosimetry (PVC and CTA).

Experiments at Sterilization facility equipped with **ELEKTROINK** accelerator, and Samples irradiation (figures below):



Apart from hard work, there was also time for fun together. On Sunday students and supervisors visited the "Rancho pod Bocianem" where attractions awaited them: a rope park and air gun shooting. After having fun together, there was a barbecue and a bonfire, where international hits were sung accompanied by a guitar.



The BTS24 survey graded the theoretical presentations given in content (new information obtained during the lecture, Form (attractiveness of the message, presentation of the material) and lecturer's competences. The average grades over 5 were respectively: 4.2, 4.3 and 4.5.

For the hands-on activities we have the following grades over 5. Group A did not fill the survey

	B	C	D	E	F	Average
Physics case	4.2	4.7	4.0	4.7	4.7	4.4
Instrumentation	5	4,7	3	4.3	5	4.4
Competence of trainer	5	5	4.7	5	4.7	4.9
Creativity of activity	4.3	3.7	3.7	4.0	3.7	3.9

Other questions were:

- What did they appreciate the most about the school? The general answer was learning about other facilities.
- What did they appreciate less? Some considered that the hours in the laboratories were too long and other that they would have preferred to participate in at least two hands-on activities.
- Did the participating in the school teach you something? Unanimously they answer yes.
- What should be changed for the next training school? Some wanted more networking hours, other less long laboratory hours, other to know in advance when the schools will be held

In other comments , many thanked the organizers for the nice environment and experience, a good balance between lecturers (9) and hands-on work.

ADVANCED TRAINING SCHOOL DEDICATED TO OPERATION OF ACCELERATORS, JUNE 3RD – 7TH, 2024, CERN, GENEVA

The first **Advanced training school dedicated to Operation of Accelerators** was organized at **CERN, Geneva, Switzerland in June 3rd – 7th, 2024**, organized by Maria J G Borge (chair, IEM-CSIC), Ilias Efthymiopoulos (CERN), Roberto Corsini (CERN), Tirsi Prebibaj (CERN), Alberto Rodriguez (CERN).

It involved hands-on activities in three facilities: CLEAR, ISOLDE and PSBooster. The training covered an introduction to accelerators, control systems, beam characterization, steering algorithms, phasing Superconducting cavities and other advanced topics.

Eighteen students (trainees), 28% women, from European institutions were selected for hands-on activities at three facilities at CERN: CLEAR (accelerating electrons), PSBooster (accelerating protons) and ISOLDE (accelerating heavy ions). See web page <https://indico.cern.ch/event/1357293/>

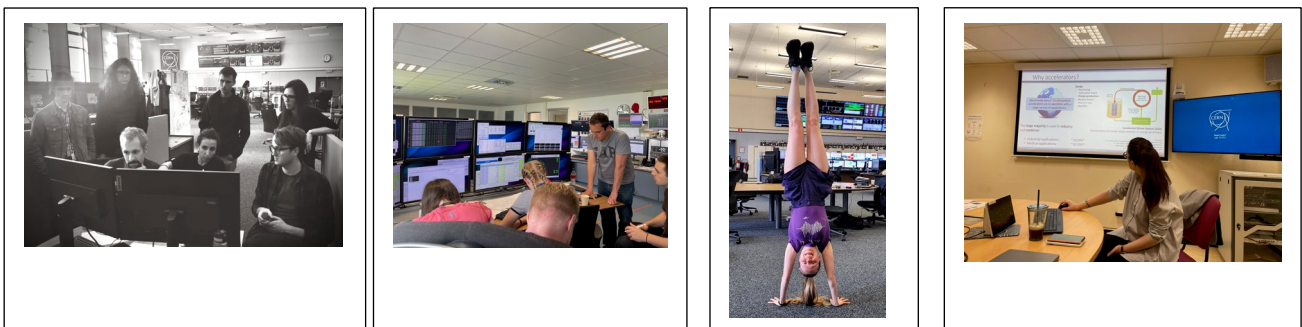
The course had on Monday and Wednesday morning introductory lessons; the rest were hands-on activities. The course started with an opening and overview of the CERN accelerators given by the local organizer Ilias Efthymiopoulos followed by an introduction to the High-energy Electron beams and the clear facility given by leader Roberto Corsini.

This was followed by a very didactic and complete introduction to accelerator and beam dynamics was done by Foteini Asvesta. The hands-on activities were coordinated by Roberto Corsini and Pierre Korysko for CLEAR, Alberto Rodríguez and Miguel Lozano for ISOLDE and Foteini Asvestas and Tirsi Prebibaj for the PSbooster. Completion of the lesson on introduction on accelerators and beam design simulation and tracking were done Wednesday morning by Foteini Asvestas and Tirsi Prebibaj, respectively. Friday afternoon the students gave presentation about their interest and their take home message from the ATSOA 2024.

The trainees were divided in 3 groups of 6 students for the hands-on sessions that took place at the Cern Control Centre (CCC), ISOLDE and CLEAR. At the CCC two work stations were prepared for the trainees between the CPS-SPS islands, the proposed activities were done in parallel to normal operation. Some of the topics covered were control systems for the PSB and scripting with Python; accelerator tuning and adjustments (beam intensity, emittance, tune, energy spread,...), beam

measurements (orbit, tune, chromaticity, beam profiles, ...); and more advanced topics (resonance/beta-beating compensation, instabilities, ...). At ISOLDE, the training started with a general presentation of the facility including a visit to the low- and high-energy transfer lines, the Penning trap, the charge breeder and the RFQ device. In addition, topics such as vacuum technology, beam instrumentation, RF systems, cryogenics, magnets/electrostatic devices... were briefly covered. The practical work was dedicated to introduce the software applications needed to operate the ISOLDE facility; how to do mass/charge scans after the charge breeder (i.e., stable contaminants characterization); phasing of the superconducting cavities; beam energy measurements and scaling of the machine for beams with different mass/charge ratios.

At CLEAR the program covered basic beam set-up, quad scans for emittance measurements and bunch length measurements; the use of steering algorithms (including dispersion free steering) and transverse optics matching.



Students at CLEAR, ISOLDE, Marie showing her skills at CCC, and a course by Foteini Asvestas

A questionnaire of satisfaction/ evaluation was filled by the trainees anonymously. Half of the trainees engineers from academic institutions and at least three were operators at facilities. Among the comments in their presentations the last afternoon one of a PhD student in accelerators mentioned: *“I’ve studied multiple courses in accelerator physics theory. This was my first time seeing most of these phenomena in reality! Highly recommend for anyone who have studied a course in accelerator physics.”*

All the 18 trainees belonged to European institutions although they were coming from different continents. As Geneva was a new place for many of them, a dinner and an evening walk was organized (photo below).



□

The introductory lessons and the presentation of the students are all available at the link of the event: <https://indico.cern.ch/event/1357293/> including the survey,

<https://indico.cern.ch/event/1357293/surveys/5456?token=63dfe61f-d456-4cc6-bae0-1aa255816f8a>

At end of the training, the trainees were invited to answer a questionnaire regarding the ATSOA 2024 at CERN. The importance of their feedback to the organizers and the EURO-LABS Management, particularly for making improvements to future training events was conveyed to the students. The survey covers various aspects of this complex training even, included a free text field at the end where students can offer additional opinions or feedback beyond the provided questions. All answers remain anonymous.

The survey was divided in several parts, the average notes are giving in parenthesis.

Event Organization

Evaluate the organizational aspects of the event. Results in parenthesis

*How you got informed on the ATSOA event?**

- e-mail from organizers (14.3%)
- EURO-LABS web page
- Supervisor (50%)
- Friends or colleagues (21.4%)
- Conference or Workshop
- Discussed in my experiment/work
- Other (specify): ISOLDE mailing list and NUSTAR mailing list (14.3 %)

Event announcement (In the questions below you will rate the organizational aspects of the event. 1 = very poor, 2=poor, 3=sufficient, 4=good, 5=satisfactory, 6 = excellent)

Information provided at the time of the event announcement? (3.9)

Response to your application, selection delay, information on outcome (4.2)

Content and organization of the event web page (3.7)

Organization of Accommodation (4.2)

Overall satisfaction **(4.4)**

Comments on organization: The transparencies should have been posted earlier

The size of the teams (6 students) was

too small

correct (100%)

too big

Scientific part

In the questions below you will rate the scientific aspects of the event.

1 = very poor, 2=poor, 3=sufficient, 4=good, 5=satisfactory, 6 = excellent

- Do you think the proposed themes of the school were well covered? (5,54)
- Was the level of the courses matching your knowledge? (5.15)

- Would you have preferred the organisers define knowledge pre-requisites attend the school?
 - No selection (35.7%)
 - Yes (28.7%)
 - No (35.7%)
- Do you think that the organization of the school allowed enough time for discussions between the students and the lecturers?
 - No selection (21.4%)
 - Yes (78.6%)
 - No (0 %)
- Which moments were most useful for discussions (you can click in several)?
 - during the lectures (28,6%)
 - during the hands-on sessions (85,7%)
 - during the coffee breaks (28,6%)
 - during the meals times (14,3%)
 - during the leisure time (14,3%)
- Did you get the opportunity to ((several choices possible):
 - meet experts (85,7%)
 - update and improve your knowledge (85,7%)
 - learn new concepts (92,86 %)
 - initiate collaborations (35,7 %)
 - ideas for new studies or projects (42,9%)

The length of the hands-on sessions compared to the lectures

Balanced 1=too long, 2=balanced, 3=too short

The average given was 2.3

Was it positive to see several facilities?

Yes (100%)

No (0%)

The overall feedback was very positive, in summary for the students: “Very intense however also a very good week”. They expected to get much more organizational details in advance than received. This should be improved for the edition next year.

EURO-LABS ADVANCED TRAINING ON OPEN SCIENCE AND DATA MANAGEMENT

An Advanced Training School is planned to take place at GSI/FAIR, this coming November. The organizers announced it as the **EURO-LABS Advanced Training on Open Science and Data**

Management in cooperation with the Helmholtz Graduate School for Hadron and Ion Research. The Advanced Training will take place at castle Ebernburg (Bad Kreuznach, Germany) from **24th to 29th of November 2024**.

Open Science is the practice of making scientific research output openly available in the form of data, software, publications, hardware and infrastructure. This promotes transparency, collaboration, and reproducibility in research, as well as wider access to knowledge for the public and to researchers. The goal of the Advanced Training course is to convey basic principles and to demonstrate commonly used tools to achieve this goal successfully.

The school is open to PhD students, final year master degree students, and early career Postdocs. 25-30 participants will be selected from the applications. There is a contingent of places reserved for HGS-HIRE participants. Economy class travel within Europe, accommodation, and subsistence will be supported by EURO-LABS and HGS-HIRE. The applications can be submitted via the indico webpage until the **29th September 2024**.

A visit to the GSI Helmholtzzentrum für Schwerionenforschung and FAIR (Facility for Antiproton and Ion Research, that is presently under construction) Darmstadt is planned. The trainees will have the opportunity to see the accelerator facility and various experiment setups as well as the FAIR construction site, in order to experience the inside of a nuclear physics research laboratory.

Organizers: Andrew Mistry (GSI/FAIR), Christine Hornung (GSI), Gerhard Baur (HGS-HIRE), Antoine Lemasson (CNRS - GANIL) and Maria J. G. Borge (CSIC)

Information and registration:

Email: euro-labs-school@gsi.de

Website: <https://indico.gsi.de/event/19808/>

Registration deadline is September 29, 2024

4. SCHOOLS/WORK SHOPS SUPPORTED BY EURO-LABS TASK 5.4

In addition to events which were organized, as part of the TSB strategy, EURO-LABS has supported events that are falling in the category of training and were organized by beneficiary institutions.

R-MATRIX SCHOOL

The R-matrix Summer School took place in Edinburgh on 23-28 June 2024.

We had a total of **34 participants**, with the following breakdown:

- 3 Undergraduates
- 20 PhD students
- 5 post-doctoral researchers (of whom, two acting as Teaching Assistants)
- 6 Faculty/Staff members

The female to male ratio was 10/24 (29%) across all participants

The Local Organizing Committee received €5000 from EURO-LABS, which were greatly acknowledged. The money was spent to support accommodation and coffee breaks for 9 European PhD students.

The school comprised lectures delivered by Prof. Carl Brune (Ohio University) on the R-matrix theory and formalism, interspersed with hands-on activities led by Prof. James deBoer on the use of the AZURE2 R-Matrix code. The hands-on activities were also supported by two Teaching Assistants, Dr. Jakub Skowronski (University of Padova, Italy) and Dr David Rapagnani (University of Naples, Italy). Dr Skowronski also delivered a lecture on the use of the Brick Python package for the treatment of uncertainties with both a frequentist and a Bayesian approach.

Further info on the even can be found at the School's website:

<https://indico.ph.ed.ac.uk/event/274/>

4.2 NPA XI SCHOOL

As a satellite to the Nuclear Physics for Astrophysics XI conference (NPA XI), a school for students is organized by ChETEC-INFRA at HZDR Dresden from 15th to 22nd of September 2024. The TSB decided to support the participation of 6 students and 1 lecturer to this school.

5. NEXT STEPS

The events organized or sponsored so far under Task 5.4 of WP5 EURO-LABS work on the fact that training should be an important part of the access to European Research Infrastructures, in particular the three fields involved in the project, which are based traditionally on large installations and facilities. The education of future generations plays a key role in the research activities in our field and especially for the next generation. Hands-on activities, where possible, are appreciated by the "trainees", students, masters or even post-docs, who are looking, depending of their career stage, to decide where to go in terms of science fields, which particular topics to approach or which institutions or facilities to seek as their future employers. It should be noted that while EURO-LABS is mainly European (has associate partner from outside Europe), many young people from other continents and/or working in institutions from other continents are applying, and coming to the events that were organized.

The complexity of our fields, nuclear and particle physics, and of the instruments and facilities involved make these training events very important and essential. Choosing small and medium size facilities among the large repertoire of EURO-LABS institutions turned out to be useful for hosting Basic Training Schools, as it is easier to obtain and schedule beamtime for hands-on activities appropriate for beginners. The Advanced Training Schools are planned at larger facilities, where the information on more complex facilities, equipment and experimental procedures complement and complete the scope. If experimentalists seem to be the targets of schools of EURO-LABS, the success of the R-matrix school shows that theoreticians need and seek training too.

An advanced training school is scheduled soon and it will focus on: Open Science and Data Management, subject of current importance. For 2025, Training School Board received the proposal from Sevilla to host BTS25 and from IFIN-HH for BTS in 2026. The Advanced training school on Operation of accelerators is planned to be repeated at CERN in 2025. GANIL will host the next advanced school in 2026, in conjunction with IPAC'26.

Furthermore, the evaluation of proposals for supporting mainstream schools will complement training events organized directly by EURO-LABS.